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(54) Treadmill with trampoline-like surface.

(57) A treadmill with a trampoline-like surface provides an improved peripheral support which tensions the belt in both longitudinal and lateral directions using pairs of angularly oriented springs each pair extending from a roller bracket at an angle of, e.g., forty-five degrees (45°) to the lateral edge of the mat, connecting thereto at spaced apart positions. The improved spring support tensions the belt with both longitudinal and lateral (or transverse) load components.

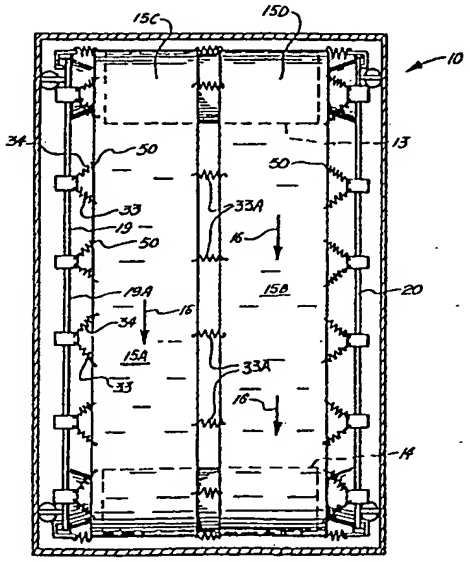

FIG. 1.

EP 0 334 608 A2

Description

TREADMILL WITH TRAMPOLINE-LIKE SURFACE

BACKGROUND OF THE INVENTION:

1. Field of the Invention:

This invention relates to treadmills and, more particularly, to an improved treadmill apparatus which is formed with a trampoline-like surface, supported by an improved multiple position peripheral spring support, that is resilient enough to minimize shock when the foot of an exerciser engages the treadmill surface but rigid enough not to interfere with the normal walking, jogging or running motions.

Treadmills utilize an endless moving belt that allows an individual to walk, jog or run in place. Treadmills are useful not only for exercise purposes, but for rehabilitation programs and medical testing such as the popular "stress test." There is also a demand for treadmills in indoor health clubs since many clubs are not able to build a running track and such a treadmill provides the capability of a well rounded exercise program.

Treadmill traditionally are formed with a thin endless belt which travels over a supporting surface such as a metal plate so that the belt can withstand the weight of the individual using it. The belt in such a design has a tendency to wear of the frictional contact between the plate and belt. The metal support forms a rigid surface that can create various injuries such as "stone bruise" or "shin splints" because of its hard, unyielding surface. Another possible way of supporting the belt is to provide rollers under the belt. This construction is not totally desirable because the rollers provide an uneven exercise surface.

Thus, exercising on a treadmill with a rigid support surface underneath the belt is similar to exercising on a hard surface because the impact of the feet of the exerciser and the support surface for each step which is taken. This tends to exert undue strain on the legs, which is a common cause of leg problems for joggers and runners and is particularly bothersome for patients who are undergoing a rehabilitation program.

Several treadmill devices are the subject of U.S. Patents. The Jones U.S. Patent No. 2,315,485, issued April 6, 1943, entitled "Exercising Device," shows an exercising machine having a moving belt, end rollers supporting the belt at its end portions, and an adjustment for varying the tension of the belt.

The Volk U.S. Patent No. 921,755, issued May 18, 1909, illustrates a treadmill-type device constructed of cross slats, each carrying anti-friction rollers. Other treadmill devices including the Haracz U.S. Patent No. 3,628,654, entitled "Vacuum Belt Conveyor;" the Hagan U.S. Patent No. 3,689,066, entitled "Treadmill Exercising Device With Yieldable Belt Support;" and German Patent No. 2,503,118, entitled "Movable Endless Band Apparatus For Physical Training, Containing Profiled Rails Connected To Band." Applicants are the owners of prior U.S. Patent No. 4,548,405, issued October 22, 1985, entitled "Treadmill With Trampoline-Like Surface," which discloses a treadmill having a belt surface supported at its lateral edges with springs and between front and rear rollers.

The present invention provides an improvement to these above-referenced patents in that an improved spring geometry supports the lateral edges of the belt in both lateral and longitudinal directions by means of a pair of spaced apart angularly extending springs which contact the belt at spaced positions. Further, Applicants' invention provides an improved treadmill apparatus which may utilize a secondary surface, spaced below the belt upper surface, that limits the vertical deflection of the belt during use. The secondary surface maintains stability of the belt when it is used by very heavy persons or by runners that exercise vigorously.

SUMMARY OF THE INVENTION:

A treadmill has been developed in accordance with the Invention which provides an improved vertically deflecting surface that is designed to eliminate the need for any rigid reinforcing surfaces directly underneath the belt. The supporting belt surface is resilient enough to absorb shock so that people can walk, jog or run with less strain on their legs and at the same time rigid enough to provide a stable exercising surface.

The treadmill which embodies the invention includes an endless belt, the uppermost side of which is adapted to form a flat surface capable of supporting an individual. An improved lateral support extends along the edge of the endless belt defining the belt shape while supporting the endless belt continuously. The belt is supported with spring assemblies by a pair of continuous rails that are spaced from and extend along the lateral edges of the endless belt. Curved sections of the rail define the curved end portions of the belt in one embodiment. The edges of the belt are connected to their respective rails through a plurality of pairs of coil springs, each pair carried by a roller bracket and each pair connected at spaced apart positions to the belt. The roller brackets rotatably engage the rail and travel thereon. In the preferred embodiment, the roller bracket assemblies slidably engage each rail and are faced toward the edge of the belt, and the roller brackets are connected at spaced apart positions along the belt, each bracket carrying a pair of springs which extend from the bracket at angles with respect to each other so that the springs attach to spaced apart positions along the edge of the belt. This improved spring arrangement provides both longitudinal and lateral load carrying to the edge of the belt for increased longitudinal and lateral stability. This improved spring arrangement provides both longitudinal and lateral support to the roller brackets for the maintenance of their alignment with the rails they engage.

In the preferred embodiment, the treadmill in-

cludes a peripheral support which is spaced from and extends substantially along the sides of the endless belt and includes curved supporting portions at each end of, and on both sides of the endless belt. In this embodiment, two extra rollers are attached to each roller bracket mounted inside the support railing and with their axis at 90° to the load bearing roller in each bracket. These extra rollers engage the curved supporting portions at each end to maintain the alignment of the load bearing roller with the support rail without the continuous support rollers shown at each end of the endless belt in previous embodiments. The springs are arranged in pairs and are angularly positioned with respect to each other for applying tension to the belt in both lateral and longitudinal directions at each position where a respective pair of springs attaches the endless belt. Preferably two springs extend from each roller bracket at an acute angle of forty-five degrees (45°), for example, with respect to the longitudinal axis of the belt. In this manner, a longitudinal and a lateral load component tension the belt at each spring.

In the preferred embodiment, the apparatus includes at least one drive roller so that the belt is driven through frictional contact between the inner surface of the belt and the drive roller.

In the preferred embodiment, the drive roller is mounted upon a rotating shaft. The shaft can carry a pair of spaced apart wheels on the opposite respective side portions of the drive roller for supporting the belt at its periphery.

In one embodiment of the apparatus of the present invention, a secondary surface is positioned under the belt for limiting vertical deflection of the belt during use such as for limiting the amount of downward movement of the belt when it is used by heavier persons.

In another embodiment of the apparatus of the present invention, the belt is segmented, comprising a plurality of belt sections, each of the sections being connected by tensile members, such as for example, coil springs or an elastomeric member for forming a tensile load transfer between the edges of adjacent belt sections.

BRIEF DESCRIPTION OF THE DRAWINGS:

For a further understanding of the nature, objects, and advantages of the present invention, reference should be had to the following detailed description, taken in conjunction with the accompanying drawings, in which like reference numerals denote like elements, and wherein:

Figure 1 is a top view of one embodiment of the apparatus of the present invention;

Figure 2 is a top view of the preferred embodiment of the apparatus of the present invention;

Figure 3 is a partial sectional view of one embodiment of the apparatus of the present invention;

Figure 3A is a partial sectional fragmentary view of the preferred embodiment of the apparatus of the present invention.

Figure 4 is a partial sectional elevational view of the preferred embodiment of the apparatus of the present invention;

Figure 5 is an elevational fragmentary view of the preferred embodiment of the apparatus of the present invention illustrating the roller bracket assemblies;

Figure 6 is a fragmentary perspective view of the preferred embodiment of the apparatus of the present invention illustrating the roller bracket assembly;

Figure 7 is a sectional elevational view of another embodiment of the apparatus of the present invention;

Figure 8 is a sectional elevational view of another embodiment of the apparatus of the present invention shown during use;

Figure 9 is a sectional elevational view of the preferred embodiment of the apparatus of the present invention illustrating the secondary support surface portion thereof;

Figure 10 is a sectional elevational view of the preferred embodiment of the apparatus of the present invention illustrating the secondary support surface ;

Figure 11 is a partial fragmentary view illustrating the drive shaft and side wheel portions of the drive roller assembly;

Figure 12 is another fragmentary view of the drive roller assembly illustrating the side wheels, the drive roller and the foam cover;

Figure 13 is an elevational view of one embodiment of the apparatus of the present invention illustrating the improved hand rail construction;

Figure 14 is a plan top view of the embodiment of Figure 13;

Figure 15 is a fragmentary view of the embodiment of Figure 13;

Figure 16 is a fragmentary elevational view of the embodiment of Figure 13;

Figure 17 is a schematic elevational view illustrating the belt tensioning mechanism;

Figures 18A - 18B are top schematic views illustrating an alternate bias weave mat for use with the apparatus of the present invention.

Figure 19 is a fragmentary view of the apparatus of the present invention illustrating an alternate, adjustable carrier portion thereof;

Figure 20 is an enlarged schematic plan view of the preferred embodiment of the apparatus of the present invention illustrating the spring and transporter configuration in detail;

Figure 21 is an enlarged schematic plan view illustrating alternate, non-tensile connecting member for use with the bias weave mat;

Figure 22 is an elevational view of another embodiment of the apparatus of the present invention;

Figure 23 is an elevation view of another alternate embodiment of the apparatus of the present invention illustrating an array of coil spring supports for supporting the mat;

Figure 24 is yet another embodiment of the apparatus of the present invention illustrating a deflected upper mat surface configuration; and

Figure 25 is a schematic fragmentary view of an alternate embodiment of the transporter portion of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT:

Figures 1 and 2 show generally the preferred embodiment of the apparatus of the present invention designated generally by the numeral 10. In Figure 1, there can be seen a plan view of the treadmill apparatus 10 of the present invention having a frame 12 supporting a pair of roller assemblies 13, 14 (phantom lines).

An endless belt 15 is supported so that a runner, jogger or walker can stand upon the belt surface 15A. As the belt moves in the direction shown by the Arrows 16 in Figure 1, the runner, walker or jogger can move his or herself through a typical jogging, walking, running gait yet remain in the same position as is typical with all treadmills. However, with the present invention, a cushioned trampoline-like surface 15A is provided because the peripheral edge portions 17, 18 of the belt 15 are supported by a plurality of spring assemblies, as will be described more fully hereinafter. The belt can be made of a woven plastic, for example, or like material, such as is commonly used in the manufacture of trampoline surfaces. Alternately, a laminated belt can be used having two layers of woven plastic with a foam layer therebetween.

A pair of continuous rails 19, 20 are provided on opposite edge portions of the belt 15 and spaced laterally therefrom, as shown in Figures 1 and 2. The rails include a top 19A and a bottom 19B rail portion as well as a semicircular 19C end portion both fore and aft, as shown in Figures 4 and 6. Rail 10 would be similarly shaped.

Each rail 19, 20 has a plurality of roller brackets 21 mounted thereon for travel (see Figures 5 and 6). Each roller bracket includes a bracket frame portion 22 made of suitable structural material such as stainless steel or the like. Bracket 21 supports a plurality of rollers including vertical roller 23 mounted upon vertical shaft 24 and horizontal roller 25. In the preferred embodiment, a pair of horizontal rollers 25 are shown. Each horizontal roller 25 is mounted upon a corresponding horizontal shaft 27, 28. The bracket includes a structural section, as shown in Figure 5, having vertical portions 29, 30 for supporting shafts 27, 28 and innermost, inwardly facing horizontal flange portion 31 having at least one opening 32 therein receptive of coil springs 33, 34. Bracket 21 is further comprised of an uppermost flat horizontal portion 35, lowermost horizontal portion 36 which extend outwardly of rails 19, 20 and vertical flange 37. Roller bracket 21 can utilize a single vertical roller 23, with bracket 21 being generally C-shaped, having vertical flange 22A and horizontal flange 21A portions.

Figure 19 discloses an alternate construction of roller bracket 22 wherein the bracket is adjustable so that springs 33, 34 can be stretched or relaxed as desired to increase/ decrease the tension in belt 15. In the embodiment of Figure 19, roller bracket frame portion 22A includes sections 22B and 22C which are movable with respect to each other, as each bracket member carries a slot 22D which allows the members 22B, 22C to be bolted together using bolted connection 22E. The lower flange 36A is ell-shaped, carrying roller 25A which abuts the bottom of rail 19, 20.

At its end 19C, 20C portions, rails 19, 20 include a flat semicircular portion, designated in Figure 6 by the numeral 40. Flat rail section 40 provides a flat outer curved surface 41 which has a curvature similar to that of rail section 19C, as shown in Figure 6. The flat surface 41 is adapted to receive horizontal rollers 25 thereupon so that the flat rollers engage and travel upon surface 41. The terminal ends of flat rail section 40 include beveled portions 42, 43, as shown in Figure 6, which help register rollers 25 upon surface 41.

Springs 33, 34 attach to roller bracket 21 at horizontal flange 31. Springs 33, 34 attach at two spaced apart different positions to mat 15, and more specifically to the peripheral edge 17, 18 portions thereof. Notice in Figures 1 and 2 that each roller bracket 21 carries a pair of springs 33, 34, each attaching at a grommet opening, for example, in spaced apart positions, designated by the numeral 50 in Figures 1 and 2. This arrangement places each spring 33, 34 at an acute angle with respect to mat edges 17, 18 of, for example, forty-five degrees (45°) and thus allows each spring to impart both longitudinal and lateral tension to the mat 15 at its edge 17, 18 portions. In an alternate arrangement (Figure 20) three springs are provided including two springs 33 at acute angles with respect to mat 15 lateral edge 17, 18 and a third spring 34 at right angles to edge 17, 18. In Figures 18A, 18B, and 21, bias weave mat 15E includes resilient woven members 15F, 15G that are woven at generally right angles (Figures 18A, 21) with respect to one another and preferably at forty five degree (45°) angles with respect to the mat edges 17, 18. In Figure 18B, woven members 15F, 15G are oriented at acute angles with respect to lateral edges 17, 18. With bias weave resilient mat 15E, non-tensile connecting members such as wire loops 33A can be used.

In one embodiment (Figure 1), the mat 15 can be in the form of pair of separate spaced apart mat Sections 15C, 15D, each having an upper surface 15A, 15B adapted to receive the foot of a runner, walker or a jogger during exercise sessions. Springs 33A join the mats 15C, 15D together. One skilled in the art will see that the use of rollers 13, 14 is optional because support to the peripheral edges 17, 18 of mat 15 is provided by roller assemblies 21 and by the coil springs 33, 34, as above-described even at end portions 19C, 20C of the rails 19, 20. Rollers 13, 14 can be driven and powered to rotate, for example, electrically if desired. In Figures 3-3A, roller bracket 21A does not have horizontal rollers 25. The bracket 21A can be used where end rollers 13, 14 are used to support the ends of the mat 15 instead of flat rail section 40.

In the embodiment of Figures 7 and 8, the mat edges 17, 18 are supported by shock assemblies, each including an upstanding articulating link 61 which can pivot inwardly upon pivot support 62. A

gusset member 63 extends around the bottom of rail sections 19B, 20B. A shock absorber 70 in the form of a coil spring supported at its ends by spring socket 71, 72 supports the rail sections 19, 20 while the size and constant of the spring 70 determine the degree of flexibility of the mat inwardly, as indicated by the curved Arrows 68 in Figure 8, when the leg L of a runner or walker presses against the upper surface 15B of the mat 15.

In the embodiments of Figures 9-10, a secondary surface 70 is provided which includes an upper frictionless surface 72, a middle cushioning surface of foam, for example, 73, and a lower structural surface of metal, wood or the like, designated by the numeral 74. The mats 15C, 15D could be connected by springs 33A covered by a cylindrical hose-like sleeve 33B. A pair of jack assemblies 75, 76 supported by frame 12 can be used to raise or lower the secondary surface 70 to limit the degree of vertical deflection of mat 15 downwardly.

Figures 11, 12 illustrate more particularly the construction of rollers 13, 14 as including a cylinder 13A, a drive shaft 13B, and an outer foam or other resilient surface 13C. End rollers 13D, 13E can extend upwardly and register with the mat 15 at its edge surfaces 17, 18.

Figure 22 illustrates an alternate construction designated generally by the numeral 100, which provides an underlying cantilevered support 103 positioned beneath belt 15. The belt 15 is supported at one end portion by roller 101, and at its opposite end portion by a plurality of tensioning rollers 104-106. Rollers 104-106 are mounted respectively upon support brackets 108, 109 that are affixed to a superstructure 110 portion of frame 102. Tensioning spring 107 connects to bracket 108 which is pivotally mounted to superstructure 110. Support 103 is in the form of an elongated cantilevered beam which is only attached fixedly at one end portion to bulk head 114. Its opposite free end portion 103A is free to deflect during use when a runner, jogger or the like is running upon the surface of belt 15. Super structure 110 carries an upper fixed roller 111 and a lower moving roller 112. Spring 113 is attached to frame 102 and at its opposite end portion connects to roller 112. An endless belt 114 connects between the rollers 111, 112 so that tension of the spring 113 can regulates the tension of the belt 114. Bulk head 116 slides upwardly and downwardly as it is connected by means of bolted connection 115 to bracket 118 which is supported by the spring 113. During use a runner deflects the support 103 both downwardly by compressing spring 113 and arcuately because the support 103 bends as its end portion 103A deflects during use. This produces a composite deflection which can be adjusted depending upon the configuration of the support 103, its flexibility between its ends, and the spring 113 Constant. As an exerciser engages the endless belt 15 traveling over rollers 101 and 104-106, the exerciser experiences a degree of shock absorption from both deflection of the vertically arranged coil spring 113 and the deflection motion of the elongated support 103. As the support 103 returns to its normal relaxed condition, the exerciser would receive additional vertical lift in this acceleration stage.

Figure 23 illustrates another embodiment of the present invention designated by the numeral 120. In Figure 23, an underlying support 125 is positioned under the belt 15. The support 125 would be flexible and would be supported thereunder by means of a plurality of coil springs 126-136. Otherwise, the endless belt is supported at its ends with rollers 121, 122 and upon structural frame 123. In the embodiment of Figure 23, the horizontal spacing between the springs would be varied. This would provide for a variable spring return to be applied to the exerciser's foot depending upon the position of the foot. Thus, the belt 15 could be made more or less firm in different horizontal positions for a custom shock absorption depending upon the needs of the exerciser. Additionally, the spring K rate could be varied while maintaining the array of springs 126-136 in a regular spacing. In Figure 24, a "banana"-shaped embodiment of the apparatus, designated by the numeral 150 is disclosed having a bend at 153, 154. As the foot reaches the elevated portion, toward the roller 152, there will be increased lifting power available from the springs 33-35 and from the mat because they will be farther from their normal, relaxed state. The exerciser's foot will be lifted (in the acceleration phase) to a higher point (or increased height) at the surface departure point.

Figures 13-16 illustrate an improved hand rail construction for use with the apparatus of the present invention. Frame 12 includes a forward upstanding pedestal 80 having a pair of spaced apart hand rails 81, 82 which attached to pedestal 80 using rotary bearings 83, 84. Each hand rail 81, 82 includes a top rail 85, a bottom rail 86, and a connecting rail 87 that defines a handle typically gripped by the user (see Figure 16). The angle A between lower rail 85 and handle 87 is preferably between 15° and 45°, that angle being designated by the letter "A" in Figure 16. Handle 17 can carry a switch plate 88 having a plurality of switches thereon for operating treadmill 10, for example, an on/off switch 89, a speed switch 90, and an elevation switch 91 for controlling the angle of inclination of the treadmill 10. A forward caster 92 would typically extend and retract to raise and lower the forward end portion of frame 12 thus varying the angle of inclination of the running surface defined by belt 15.

An instrument panel 93 is pivotally mounted upon cross bar 94 which connects handles 81, 82. Instrument panel 93 would include a graphics display of any number of desirable parameters, such as distance, time, pace (such as minutes per mile), or the like.

Because of the spacing of handles 81, 82, as shown in Figure 14, a runner, walker, or jogger can occupy a position between handles 81, 82 while gripping the handles 87. Because the handles rotate upon rotary bearings 83, 84, into multiple positions, as shown in Figure 13, the handles can be raised or lowered to accommodate persons of various heights. Further, the lowermost position of the handles, as shown in Figure 1, can be used for shipping purposes. Detent locking can be provided

to fix handles 81, 82 in any particular desired elevational position. Display 93 can be pivotally mounted (between 0° and 90° with respect to horizontal) upon cross bar 94, as shown by the curved arrow 95 in Figure 13, so that the graphics display can be rotated to a comfortable viewing position for any particular user. The bearings 83, 84 can be accompanied by a spring counterbalance so that lifting the handles 81, 82 is easy, even for children. The handles would typically be spaced thirty to thirty-five inches (30"-35") apart.

Figure 14 shows left and right handrails pivoting to change the distance between them. This is accomplished by mounting the handrails on hinge pins where their ends join a common crossmember. A bracket on each side of the crossmember engages each handrail a distance (e.g., six inches) from the center of the hinge pin limiting stops spaced at 4°-5° increments. This gives each handrail about twenty degrees (20°) of pivotal movement. The crossmember would also pivot to adjust the height of both handrails and provide a mounting platform and wiring conduit for the control-panel.

In Figure 25, an alternate embodiment 160 uses an elastomeric mat 161 affixed to transporter bracket 163 using a rivet 164, for example. A plurality of transporter brackets 163 each include curved portion 167 and threaded opening 170 receptive of bolt 169. Endless band 168 can be of plastic, for example, and in side view, band 168 tracks endless belt 15. Band 168 has a concave inwardly facing portion 172. Frame 162 also has a continuous concave rail portion 165 that supports ball bearings 166 as an interface between rail 165 and endless band 168.

In view of the numerous modifications which could be made to the preferred embodiments disclosed herein without departing from the scope or spirit of the present invention, the details herein are to be interpreted as illustrative and not in a limiting sense.

Claims

1. A treadmill for supporting a walker or runner with a moving trampoline-like belt surface having a longitudinal axis defined by the direction of movement of the belt during use, comprising:

a) a frame;

b) an endless belt having generally parallel lateral edges and mounted for travel upon and with respect to the frame, the belt having an uppermost surface forming a generally flat exercising surface;

c) the frame providing a fixed lateral edge support means spaced from and extending substantially along both lateral sides of the endless belt and including front and rear curved end portions;

d) transporter means for movably engaging the lateral edge support means for travel therealong and connecting the lateral edges of the endless belt to the fixed lateral edge support means to support the lateral edges along the exercising surface as the endless belt moves relative to the frame;

e) the transporter having multiple sections that can track the lateral support means independently of one another so that the transport means can turn upon the curved end portions; and

f) the connecting means including tensile means moving with the belt and the transporter means for applying tension to the lateral edges of the belt, at multiple positions along the belt at multiple spaced locations along the transporter means and at acute angles with respect to the lateral edges so that the tension means tensions the belt at its lateral edge portions with both longitudinal and lateral load components and at least partially maintains stability of the multiple sections of the transporter means upon the lateral edge support means in both longitudinal and lateral directions, as a runner or walker paces upon the endless belt in a stationary position with respect to the frame as the belt moves.

2. The treadmill of Claim 1, wherein the connecting means include a plurality of roller brackets mounted for travel upon the support means.

3. The treadmill of Claim 1, wherein the endless belt is a bias weave mat.

4. The treadmill of Claim 3, wherein the mat has first and second woven portions each oriented at generally right angles to one another and at acute angles to the lateral edge of the belt.

5. The treadmill of Claim 2, and further including at least one drive roller, the belt being driven through frictional contact between the inner surface of the belt and the drive roller.

6. The treadmill of Claim 3, and further including a shaft connecting the drive roller to the frame.

7. The treadmill of Claim 4, further comprising a pair of spaced apart wheels on the shaft positioned respectively on each side of the drive roller.

8. The treadmill of Claim 1, wherein the lateral edge support means includes a pair of continuous rails connected to the frame and extending respectively along each edge of the endless belt.

9. The treadmill of Claim 6, wherein the multiple-spaced brackets are roller bracket assemblies having rollers that engage the rail and and a pair of springs extending from each bracket at an angle with respect to each other and connecting respectively to the lateral edge of the belt at spaced apart positions on the belt.

10. The treadmill of Claim 7, wherein each spring is a coil spring connected between each bracket and the belt.

11. The treadmill apparatus of Claim 1, further comprising a secondary surface means positioned under the belt surface for limiting vertical

deflection of the belt during use.

12. The treadmill apparatus of Claim 11 wherein the secondary surface is an elongated platform supported at one endportion and being unsupported and free to deflect substantially along its length.

13. The treadmill apparatus of Claim 11, wherein the secondary surface means includes an upper surface having a low coefficient of friction.

14. The treadmill apparatus of Claim 13 wherein the secondary surface means includes a plurality of horizontally spaced apart coil springs transmitting variable load transfer characteristics in different horizontal positions to the endless belt.

15. The treadmill apparatus of Claim 11, wherein the secondary surface includes a portion that is movable in a vertical direction so that the distance between the belt surface and the secondary surface can be varied.

16. The treadmill apparatus of Claim 11, wherein the secondary surface means includes a rigid supporting layer, a flexible foam layer, and an uppermost generally frictionless surface of low coefficient of friction.

17. The treadmill apparatus of Claim 1, wherein the belt is segmented, comprising a plurality of belt sections, and further comprising tensioning means for forming a tensile load transfer between adjacent belt sections.

18. The treadmill apparatus of Claim 1, further comprising a belt cover that moves with the belt and which extends across the belt and the spring means.

19. The treadmill apparatus of Claim 1, wherein each bracket includes a plurality of rollers including at least one roller adapted to engage the outer surface of the rail at a position opposite the belt.

20. The apparatus of Claim 19, further comprising a second roller carried by the bracket and positioned generally between the rail and the mat for maintaining a generally semicircular curvature of the belt at the end portions of the belt, and further comprising a curved rail section having a surface which defines the curvature at the end of the belt and which is adapted to receive the second roller carried by the brackets, so that the second roller engages the curved rail section at the end portions of the belt.

21. The apparatus of Claim 11, further comprising a jack positioned under the secondary surface for raising and lowering the secondary surface with respect to the belt.

22. The apparatus of Claim 1, further comprising shock absorber means defining a shock absorbing connection between the frame and the peripheral support means for allowing the deflection of each upper edge portion of the belt inwardly during use.

23. The treadmill apparatus of Claim 22 wherein the shock absorbing means includes an array of springs positioned under the belt uppermost surface.

24. A treadmill apparatus, comprising:

a) a frame;

b) an endless belt mounted for travel upon the frame;

c) a pair of spaced apart handles mounted at the forward end portion of the frame and extending rearwardly on opposite sides thereof along the respective peripheral edges of the belt, each handle including gripping portion defining an angle of between 15 and 45 degrees with respect to horizontal, each handle being rotatably connected with respect to the frame, and the frame includes a pedestal extending upwardly from the treadmill surface each handle being mounted to the upper portion of the pedestal.

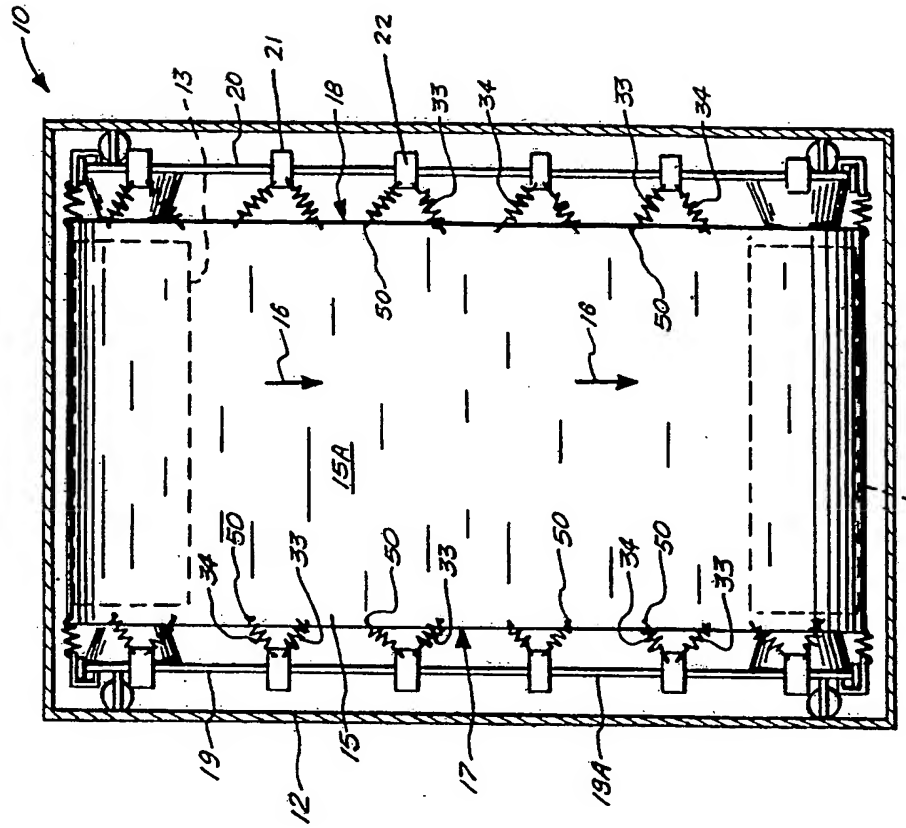
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FIG. 2.

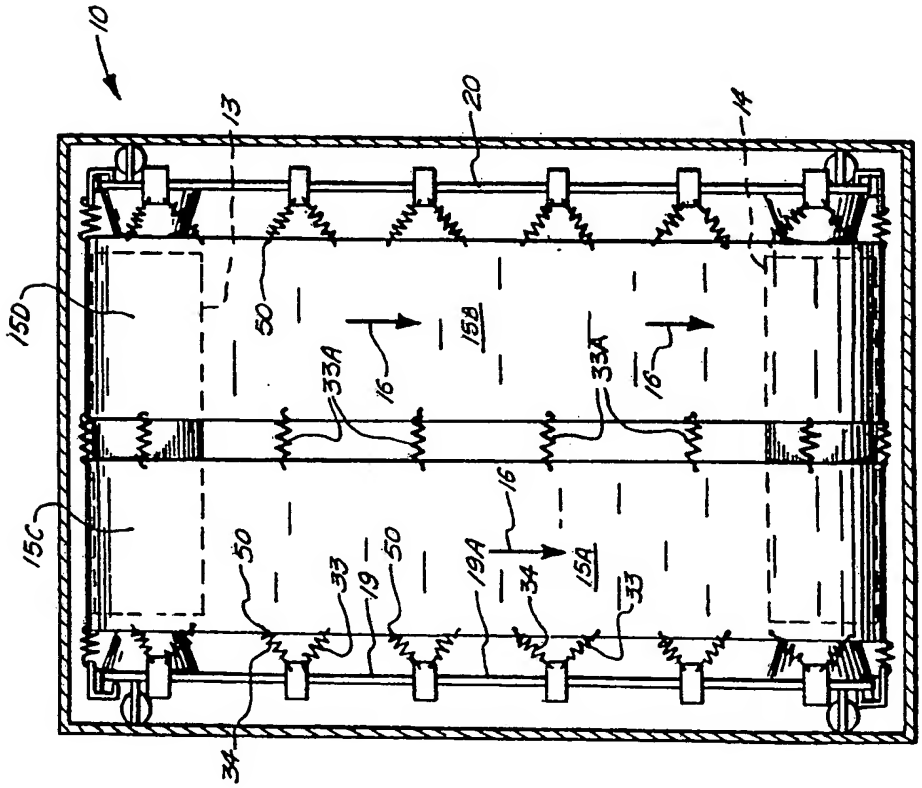
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FIG. 1.

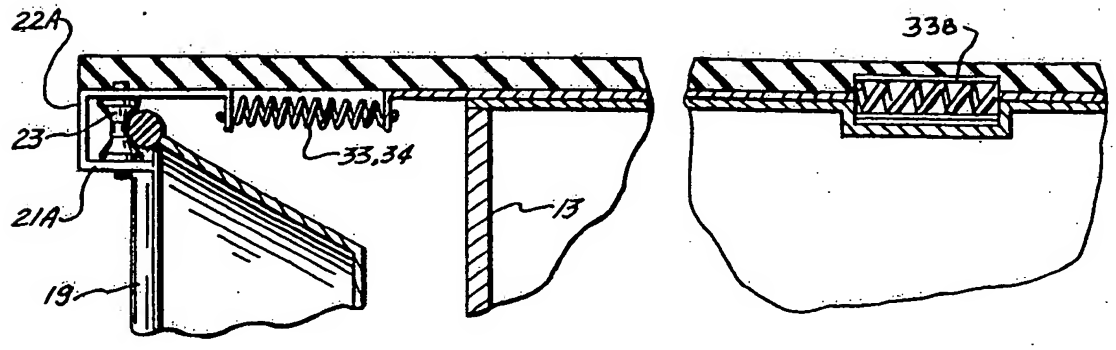

FIG. 3.

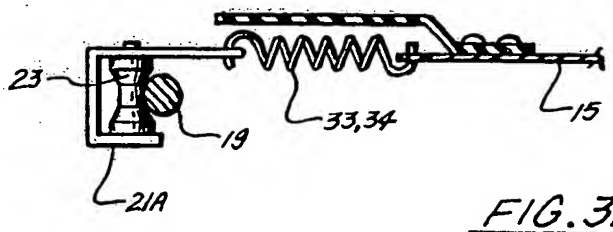

FIG. 3A.

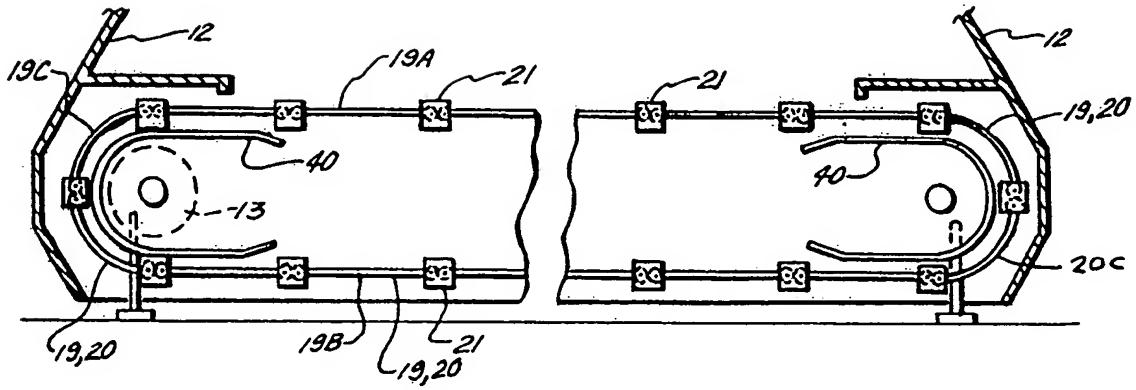

FIG. 4.

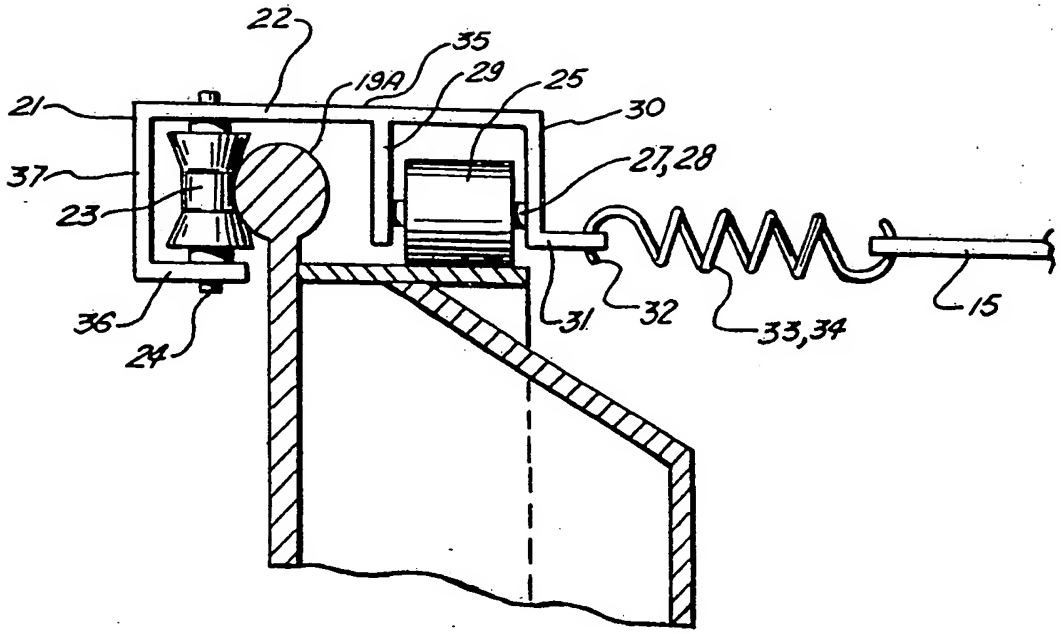
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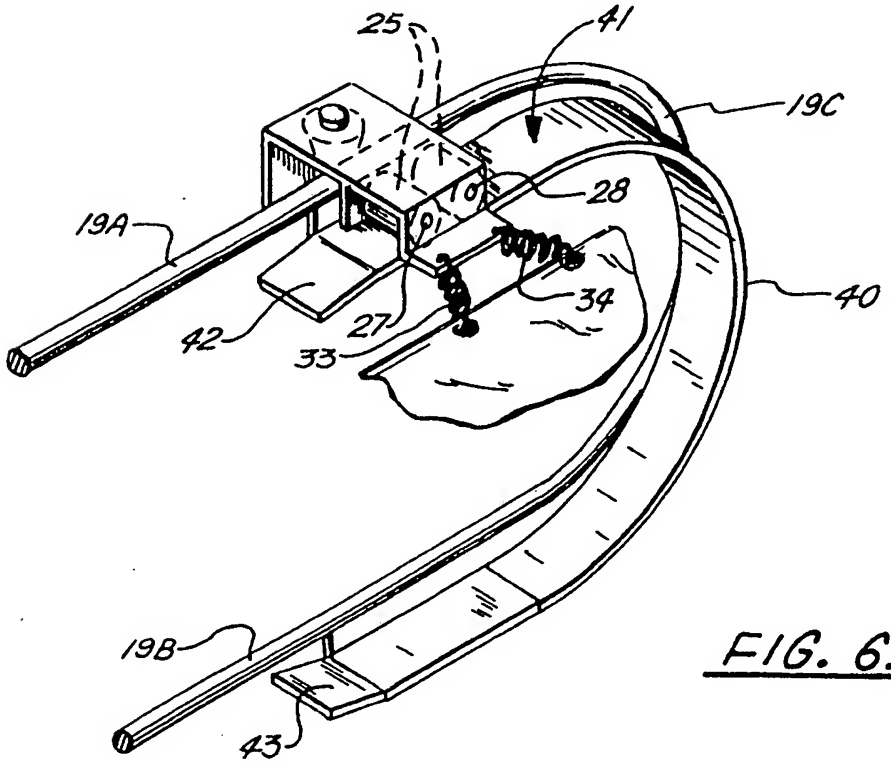
FIG. 5.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19A
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19B
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FIG. 6.

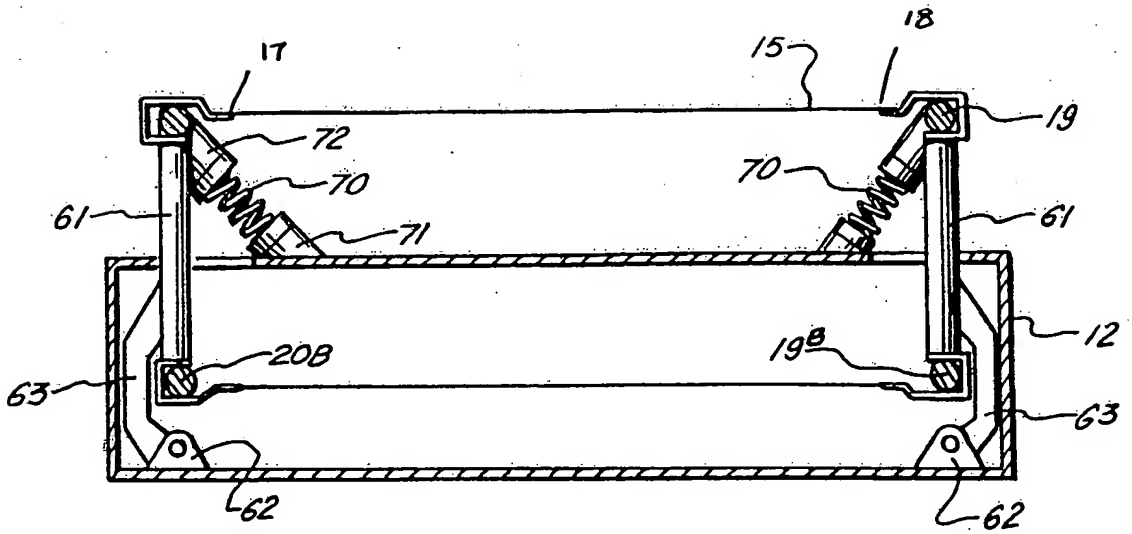
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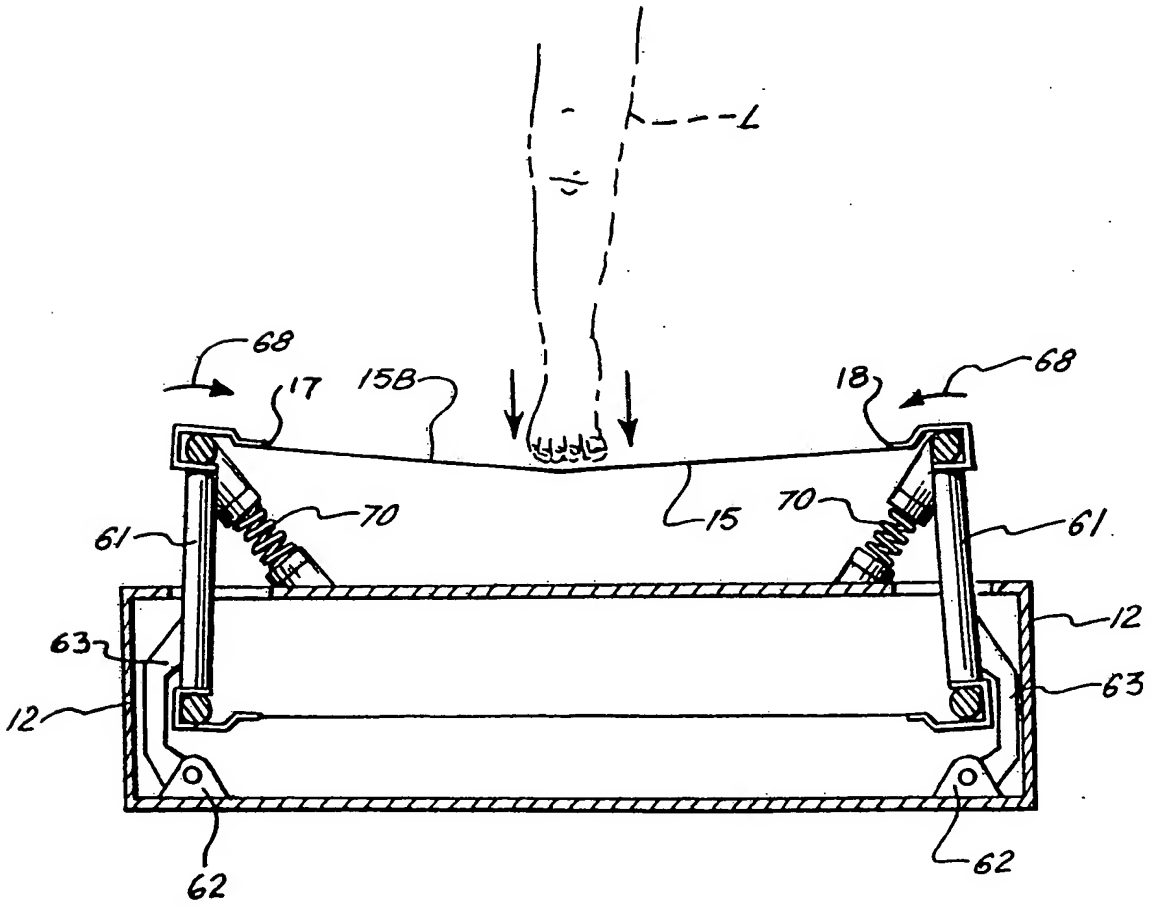
FIG. 7.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15B
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FIG. 8.

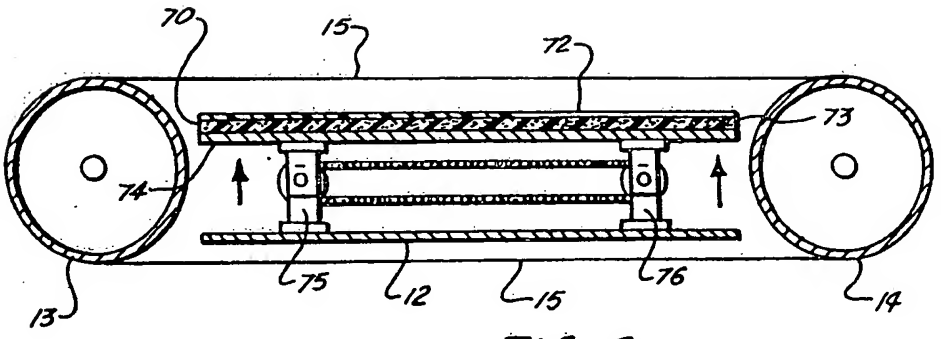

FIG. 9.

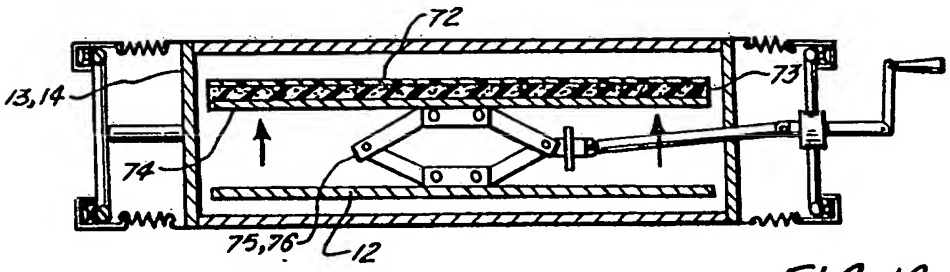

FIG. 10.

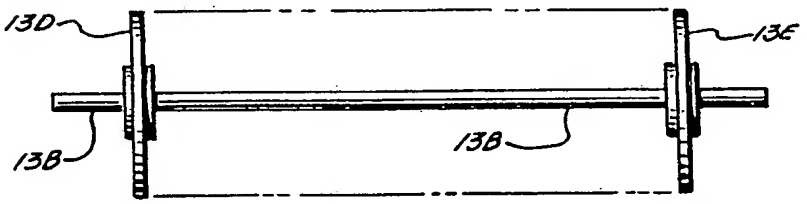

FIG. 11.

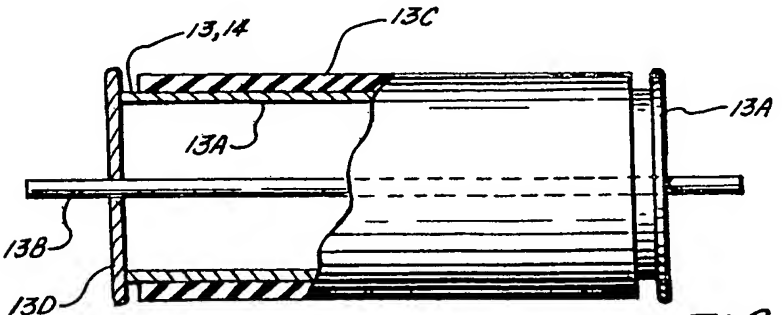

FIG. 12.

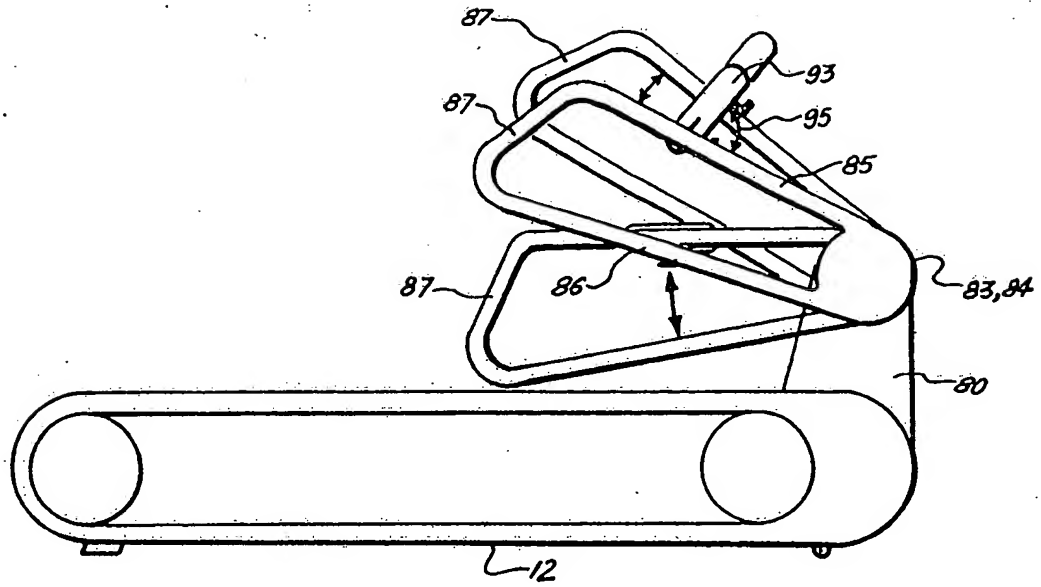

FIG. 13.

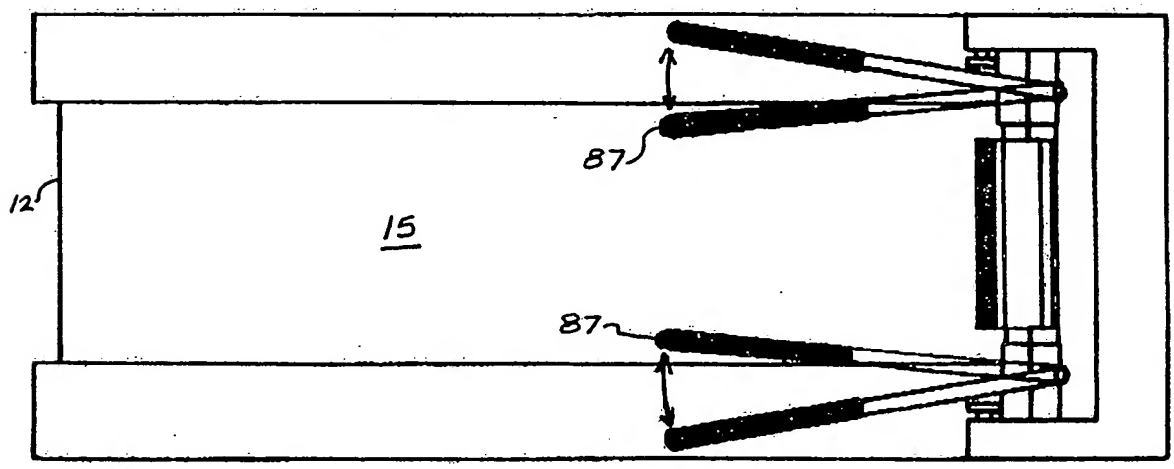

FIG. 14.

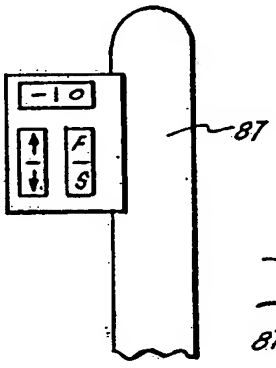

FIG. 15.

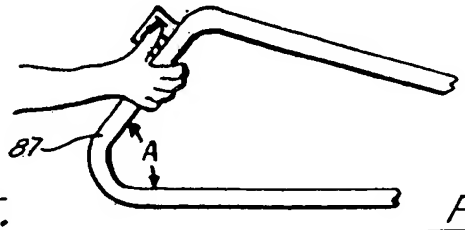

FIG. 16.

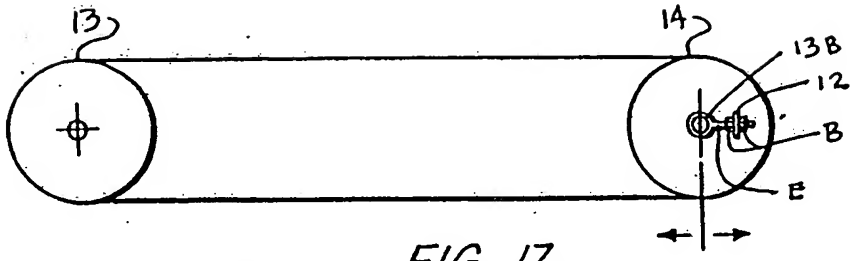

FIG. 17.

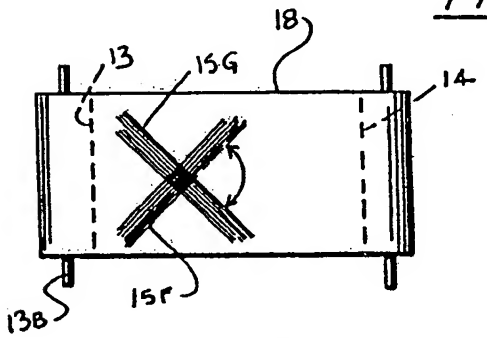

FIG. 18A.

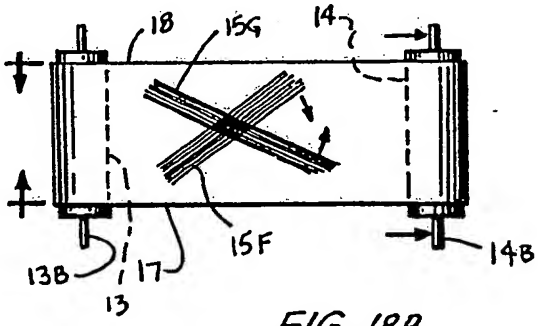

FIG. 18B.

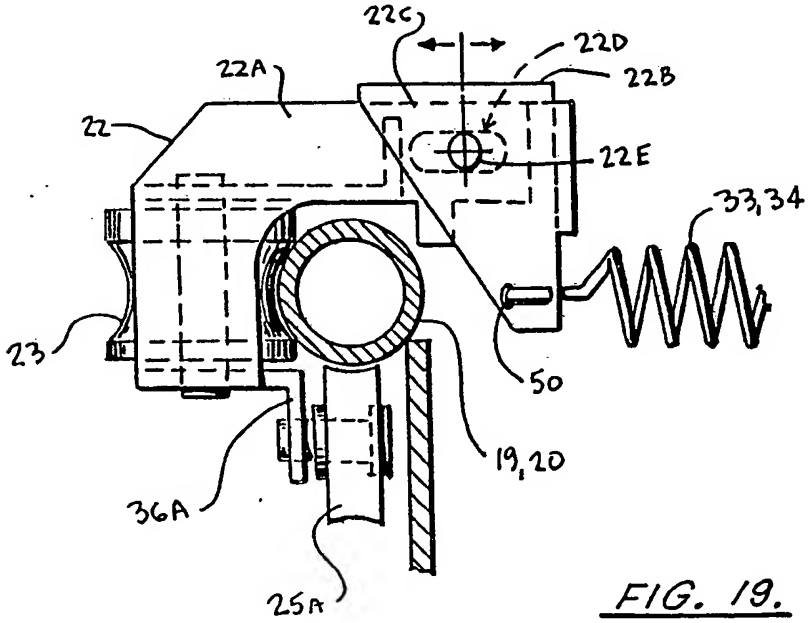

FIG. 19.

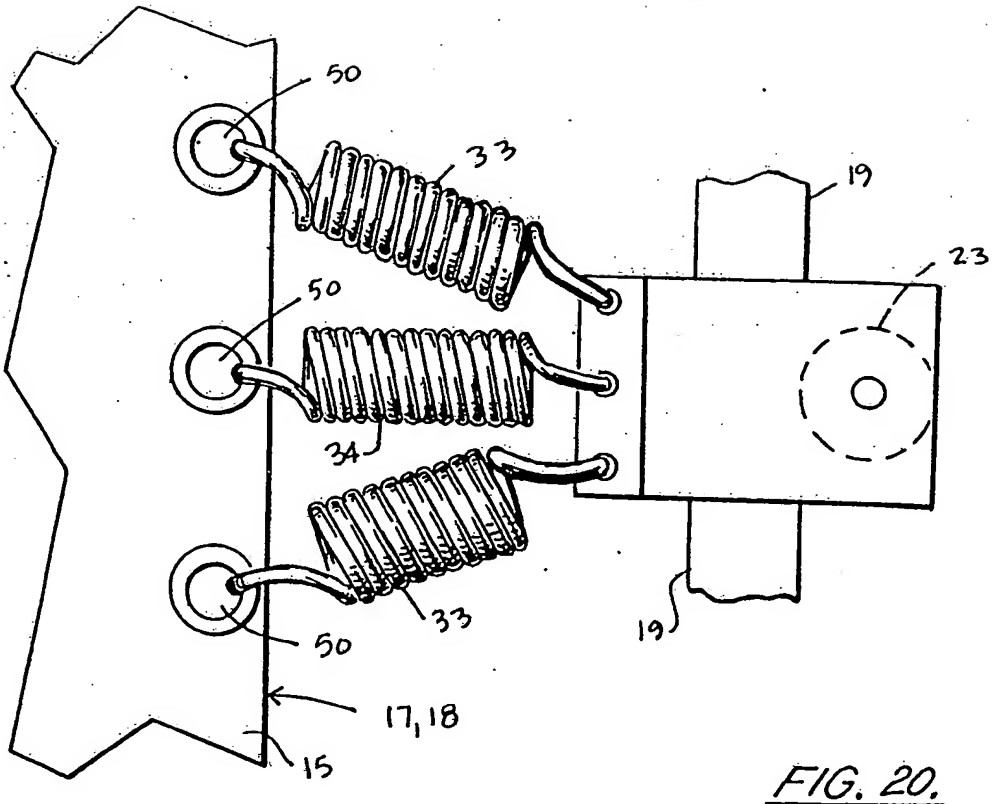
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FIG. 20.

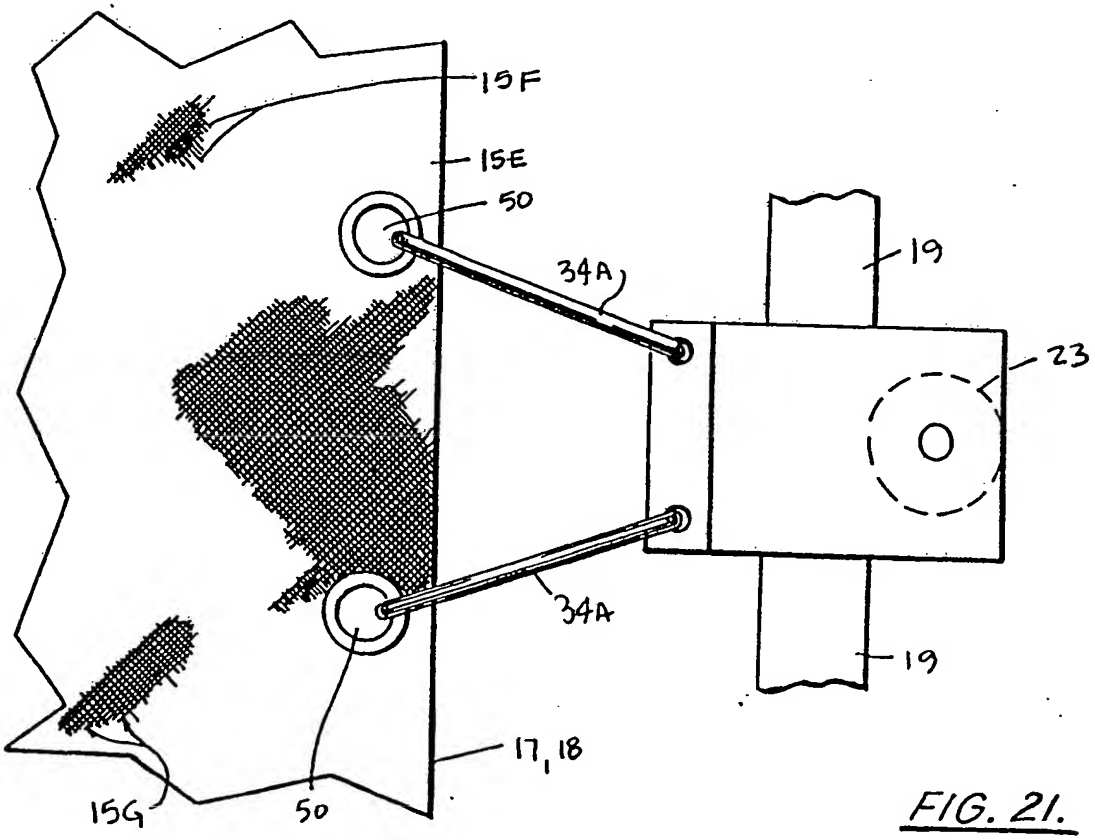
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FIG. 21.

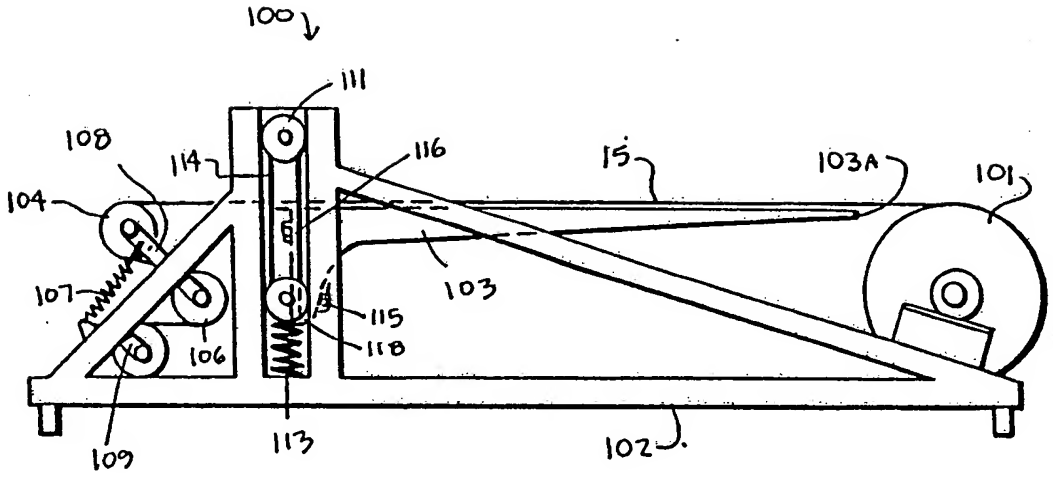
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FIG. 22.

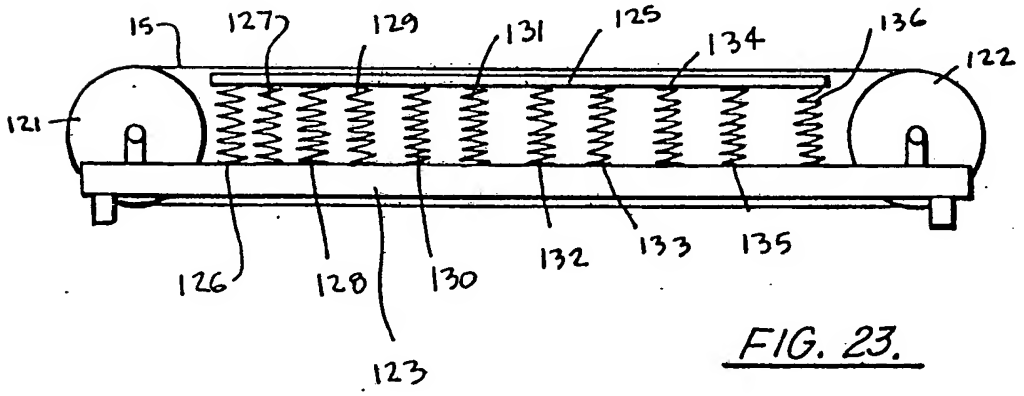
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FIG. 23.

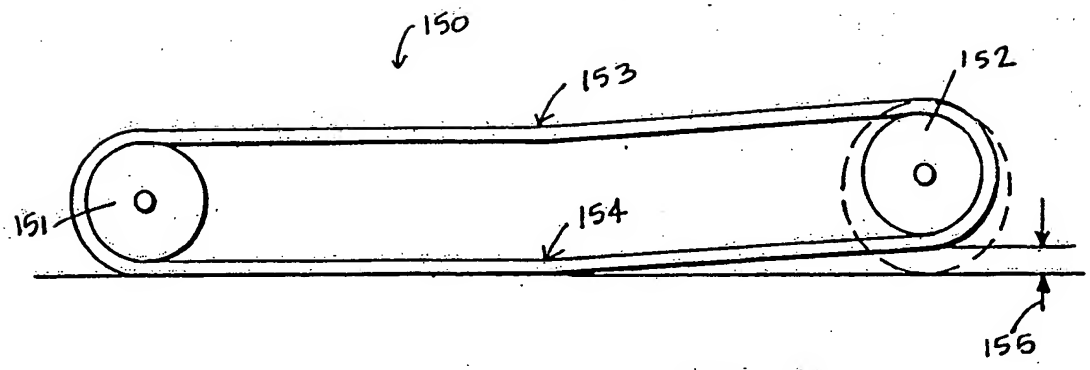
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FIG. 24.

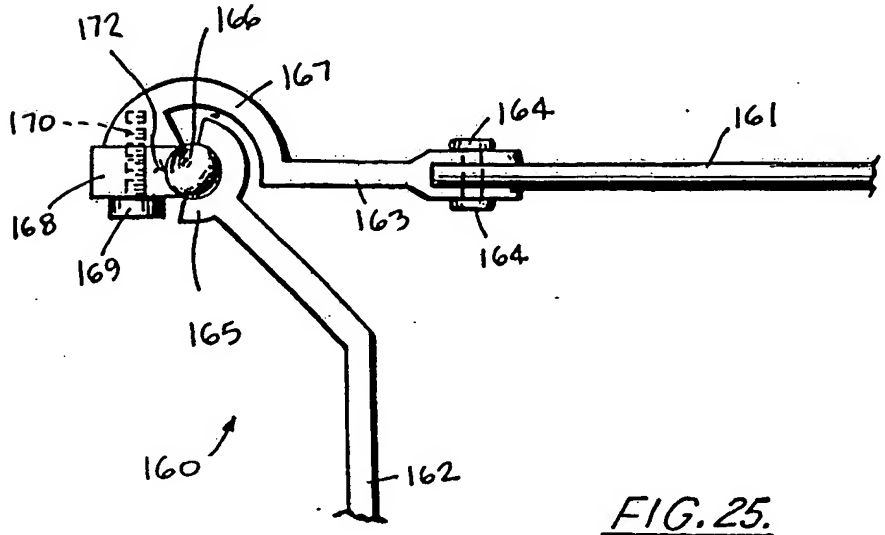
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FIG. 25.